

Road traffic injuries and road safety efforts in Saudi Arabia

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Abstract

Background: Road traffic injuries and deaths remain a major public health concern in Saudi Arabia.

Aim: To review the burden and risk factors for road traffic injuries in Saudi Arabia and describe recent government road safety efforts.

Methods: We reviewed official government documents and published literature on national trends, risk factors, emergency response and injury patterns of road traffic injuries and road safety efforts by the Government of Saudi Arabia.

Results: Between 2013 and 2023, serious road traffic accidents decreased by 46% in Saudi Arabia, fatalities by 44% and injuries by 40% as a result of stricter traffic monitoring and public awareness campaigns. In spite of this progress, the burden remains concentrated among specific population groups and regions. The key challenges include non-compliance to safety measures and non-completion of infrastructure upgrades.

Conclusion: Saudi Arabia has achieved measurable reductions in road traffic accidents, injuries and fatalities. However, achieving the Vision 2030 road safety target will require sustained enforcement, safer infrastructure, stronger road safety education, and wider use of data-driven technologies.

Keywords: road traffic injury, road traffic accident, road traffic fatality, road safety, traffic law, Saudi Arabia

Citation: Sheerah HA, Aldossari MM, Alhayyay MR, Alotaibi MB, Al-Shehri F, Almuzaini Y, et al. Road traffic injuries and road safety efforts in Saudi Arabia. *East Mediterr Health J.* 2026;32(7):470–476. <https://doi.org/10.26719/2026.32.7.470>.

Received: 21/09/2025; Accepted: 06/11/2025

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Introduction

Road traffic injuries are a major global public health challenge, causing about 1.2 million deaths and 20–50 million non-fatal injuries annually, many resulting in long-term disability (1). More than half of road traffic deaths occur among pedestrians, cyclists and motorcyclists. Most road traffic injuries occur among people aged 18–59 years, and men are 3 times as likely as women to be affected. Beyond the human toll, road traffic injuries impose a substantial economic burden, costing countries an estimated 3% of gross domestic product annually (1). Key risk factors include speeding and other risky driving behaviours, driving under the influence of drugs or alcohol, distraction, unsafe infrastructure and vehicles, and weak enforcement of traffic laws (Table 1). The United Nations General Assembly has set a target of halving global road traffic deaths and injuries by 2030 (1).

In Saudi Arabia, road traffic accidents and their resulting injuries remain a leading cause of death, especially among young adults. In 2016, the road traffic fatality rate was 28.8 per 100 000, higher than in low-income countries (24.1 per 100 000) and more than 3 times the rate in high-income countries (2,3). Road safety

has therefore been prioritised under Saudi Arabia's Vision 2030 Health Sector Transformation Programme, which aims to reduce road traffic fatalities to fewer than 10 per 100 000 population by 2030 (4). The government has implemented a multifaceted approach involving stricter traffic laws, road and infrastructure improvements, public education campaigns and improved emergency medical services (2–4).

Although road safety indicators have improved in Saudi Arabia, evidence on the burden, risk factors, injury patterns and government road safety efforts remains limited. This review summarises evidence on road traffic accidents in Saudi Arabia, including national trends, major risk factors, injury patterns and current government road safety efforts.

Methods

We conducted a review of official government documents and published literature on road traffic accidents in Saudi Arabia. We included sources describing national trends, risk factors, emergency response, injury patterns and government road safety initiatives. We summarised

Table 1 Major risk factors for road traffic accidents in Saudi Arabia

Category	Subcategory	Risk factors	Relevance to road safety
Human factors	Driving behaviour	Speeding; driving under the influence of alcohol, drugs, or medicines that impair driving; non-use of seatbelts or child restraints; distracted driving, including mobile phone use; fatigue or drowsy driving; aggressive or reckless driving; violation of traffic rules and signals	These behaviours reduce attention, reaction time and vehicle control.
	Driver characteristics	Young or older age; male sex; limited driving experience or poor driving skills; health issues, including impaired vision and cognitive function; stress, anger or risk-taking behaviour	Individual demographic, health and psychological factors can influence driving behaviour, hazard perception and crash risk.
Vehicle factors	Mechanical and technical condition	Poor vehicle maintenance (brake failure, worn tyres); vehicle age and condition; poor lighting (headlights, indicators); malfunctioning safety devices (airbags, seatbelts); vehicle overloading	Vehicle defects and poor maintenance can increase accident risk and worsen injury severity when accidents occur.
	Vehicle design and type	Motorcycles, heavy vehicles and other higher-risk vehicle types; poor stability or manoeuvrability; absence of safety features such as anti-lock braking systems and electronic stability control	Vehicle design and safety features influence stability, crash avoidance and occupant protection.
Road and environmental factors	Road design and infrastructure	Sharp curves and inadequate lanes; insufficient road signage and markings; lack of pedestrian crossings or barriers; inadequate street lighting; potholes and uneven road surfaces	Poor road design and infrastructure can reduce visibility and place pedestrians and other road users at greater risk.
	Weather and visibility	Rain, fog or dust reducing visibility; extreme heat contributing to fatigue or tyre failure; low humidity affecting vehicle performance; strong winds affecting control; night driving or glare at dawn or dusk	Environmental conditions can impair visibility, traction and driver alertness.
Other contributing factors	Systemic and policy factors	Inadequate enforcement of traffic laws; insufficient driver education and licensing standards; delayed emergency response; lack of road safety campaigns	Broader systemic issues can influence prevention and post-crash outcomes.

the evidence descriptively because the included sources varied in design, data sources and outcome definitions.

Results and discussion

Burden, characteristics and risk factors of road traffic accidents in Saudi Arabia

Burden and demographic characteristics

Data from the Ministerial Traffic Safety Committee indicate reductions in serious road traffic accidents, injuries and fatalities in Saudi Arabia during the past decade. Between 2013 and 2023, serious accidents decreased from approximately 30 000 to 16 000, fatalities from 8000 to 4500, and injuries from 40 000 to 24 000. The road traffic fatality rate decreased from 25.0 to 13.2 per 100 000 population during the same period, while the estimated financial cost decreased from 38 billion to 30 billion Saudi riyals between 2017 and 2023 (7).

Despite this progress, the burden remains concentrated among specific population groups and regions. In 2023, men accounted for 87% of road traffic fatalities, and Saudi nationals accounted for 56%. The largest proportions of road traffic fatalities and injuries were among adults aged 18–30 years (35% and 31%, respectively), followed by those aged 31–40 years (22% and 19%). Children and adolescents aged 0–17 years accounted for 14% of fatalities and 24% of injuries, while people aged 41–50 years accounted for 13% and 12%, and those aged >50 years for 16% and 14%, respectively. Makkah and Riyadh

reported the highest numbers of road traffic injuries and fatalities in the country (7).

Emergency medical response

Emergency medical response is a key component of post-crash care. In an analysis of 95 372 road traffic accidents recorded by the Saudi Red Crescent Authority between 2016 and 2020, mean response intervals were 46.2 ± 10.3 seconds for mission acceptance, 108.4 ± 15.2 seconds for ambulance mobilisation, 10.7 ± 3.1 minutes to reach the crash site, 95.3 ± 18.7 seconds to initiate treatment, and 17.4 ± 5.2 minutes spent at the scene (8).

Ambulance safety may affect emergency response capacity. In a national study of 160 ambulance-related road traffic accidents reported from January 2020 to July 2022, direct collisions accounted for 90% of cases and ambulance drivers were reported to be at fault in 42% (9). Such incidents may delay prehospital response, reduce emergency medical service efficiency and affect outcomes for injured patients.

Risk factors and high-risk driving behaviours

The evidence points consistently to risky driving behaviours as major contributors to road traffic accidents and severe injuries in Saudi Arabia. In a study of 342 male drivers treated for road traffic injuries at King Salman Armed Forces Hospital and King Khalid Armed Forces Hospital in Tabuk, 62% were aged < 36 years and 90% were from low- and middle-income groups. Mobile phone use while driving, over-speeding and overtaking

were associated with nearly 4-, 3-, and 2-fold higher likelihoods of severe injury, respectively (10).

A study of driving behaviour among 424 young drivers at Alasala Colleges in the Eastern Province, conducted between November 2021 and February 2022, found that 26% of young male drivers and 19% of young female drivers reported involvement in road traffic accidents. Aggressive and speeding-related behaviours were more common among male drivers, although risky driving behaviours were observed in both sexes. Driving experience, risky driving behaviours, vehicle type, traffic violations, mobile phone use with headphones while driving and other distractions were identified as predictors of road traffic accidents (11).

In an observational study of 1700 drivers on 13 major highways and inner-city intersection sites in Riyadh, 14% of drivers were seen using mobile phones while driving and only 34% were wearing seatbelts (12). In the Eastern Province, road traffic accident severity between 2009 and 2016 was associated with driver-related factors, including sleep deprivation, distraction, over-speeding, sudden lane deviation, collisions with vehicles, road barriers, pedestrians or motorcyclists, and adverse weather conditions, particularly rain (13).

Roundabouts and drifting

Roundabouts are circular intersections designed to improve traffic flow and reduce collision risk by slowing vehicles and minimising conflict points compared with conventional intersections. Their safety benefits depend, however, on drivers yielding to circulating traffic, signalling correctly and following lane rules. In a field study involving 384 drivers at 5 roundabouts in Riyadh, nearly 90% violated at least one traffic regulation, most commonly exiting without signalling or entering without yielding. Drivers' responses indicated limited knowledge of roundabout regulations and inadequate coverage of this topic during driver licensing and education (14).

Tafheet, or Saudi drifting, is an illegal high-speed drifting practice on public roads in which drivers deliberately cause vehicles to skid or slide sideways at high speed, often while spinning or swerving between lanes. It is usually performed using sedans or other non-sport vehicles, unlike traditional drifting, which involves high-performance cars. Spectators often gather to watch, increasing the risk of road traffic accidents involving drivers and bystanders. In a study of 799 male students in grades 7–12 from government, private and international schools in Riyadh, around 40% reported taking part in *tafheet*. This was more common among students who also reported unsafe driving behaviours, such as traffic law violations, non-use of seatbelts and mobile phone use while driving (15).

Patterns and complications of road traffic injuries

The available hospital-based studies describe the profile, severity and complications of road traffic injuries in several Saudi settings. Among 10 855 patients with road traffic injuries who presented to the emergency

department of King Khalid Hospital in Ha'il between January 2016 and December 2017, 74% were male. The most common injuries were fractures (48%), followed by lacerations (32%), crush injuries (11%), penetrating injuries (8%), abdominal and pelvic visceral injuries (1%), thoracic visceral injuries (0.4%), and amputations (0.2%) (16).

In a study of 300 patients with road traffic injuries treated at the emergency departments of King Khalid Hospital and Prince Sultan Center for Health Services in Al-Kharj between December 2018 and December 2019, 91% of patients were male and car crashes were reported as the most common cause of injury (89%). Admission to an intensive care unit was required for 22% of patients, with chest, abdomen, upper limbs, and spinal injuries contributing significantly to these admissions (17).

Among 5797 traumatic road traffic injuries registered at Aseer Central Hospital in Abha between January 2010 and December 2019, traumatic spinal injuries accounted for 14%. The patients had a mean age of 30.7 years and most were male. Lumbar and cervical injuries were the most common, occurring in 33% and 31% of cases, respectively. Overall, 7% of patients required critical care admission, and the in-hospital mortality rate was 5% (18).

In a review of 572 road traffic accident patients who presented to the Radiology Department at King Fahad Military Medical Complex in Dhahran between July 2014 and July 2017 and underwent whole body-computed tomography, no trauma-related abnormalities were detected in 31%. Head, face and neck injuries occurred in 8.8% of cases, while chest, abdomen and pelvis injuries were seen in 31%, and combined injuries in 32%. Most patients (90%) were unrestrained. The leading injury mechanism was rollover (70%), followed by frontal collisions (23%), side impacts (5%) and rear impacts (2%). The absence of trauma-related abnormalities were 10% more frequent among restrained patients. Chest, abdominal and pelvic injuries were 3% higher, and combined injuries were 10% more common among unrestrained patients. Deaths occurred only among unrestrained patients (4%), all of whom had combined injuries (19).

Trauma registry data from King Abdulaziz Medical City in Riyadh showed differences in injury severity by age and sex. Among 1314 patients aged > 14 years who had been involved in non-fatal road traffic accidents between 2015 and 2017, 88% were male and the median age was 25 years. Two-thirds of patients were admitted to a ward. Severe injury scores were more common among males, whereas females had a higher proportion of chest injuries. Head and neck injuries were similarly distributed by sex, and adults aged ≥ 65 years were more likely to have severe head, neck and chest injuries (20).

Older hospital data show that road traffic accidents have long contributed to severe trauma outcomes in Saudi Arabia. A review of trauma admissions to the surgical intensive care unit at King Khalid University Hospital, Riyadh, from 30 October 1984 to 29 October

1989, identified 181 trauma cases, representing 16% of total surgical admissions. Road traffic accidents accounted for 83% of these cases, and male patients outnumbered female patients by 6 to 1. Of the 30 deaths, 16 occurred within 24 hours and 14 after multiple organ failure. Positive cultures were found in 50% of those who died (21).

Data on 303 road traffic accident victims who were dead on arrival at the emergency department of Assir Central Hospital, Abha, between August 1989 and May 1994 showed that 45% had head and neck injuries, 39% had thoracic injuries and 35% skull fractures (22).

Government efforts to reduce the burden of road traffic accidents

Recognising the heavy human and economic toll of road traffic accidents, Saudi Arabia has implemented coordinated actions across ministries and agencies to create a safer transport system (Table 2).

Governance and strategic framework

Under Vision 2030, Saudi Arabia has adopted the safe system approach to reduce road traffic deaths and injuries through safer road design, stricter laws, stronger enforcement and improved road-user behaviour. The reforms include a demerit points system and behavioural programmes for repeat violations, as well as a graduated driver licensing system that allows new drivers to gain experience under safer conditions before obtaining full driving privileges. Vehicle inspection and registration standards have been strengthened to improve compliance with safety requirements. Pedestrian facilities are being expanded and public transport promoted to reduce

congestion and the risk of road traffic accidents. Public education is also central to the framework, supported by regularly evaluated social marketing campaigns and centralised communication to improve coordination and impact (4,23).

Established in 2018, the Ministerial Traffic Safety Committee coordinates national road safety action across government sectors, including health, transport and logistics, commerce, media, municipal and rural affairs and housing, communications and information technology, interior, and education. The committee brings together the Royal Court and international stakeholders, including WHO. It coordinates a multisectoral response to road traffic accidents, covering law enforcement, standardised data collection, trauma care, road infrastructure, vehicle safety, traffic management, public awareness and education, community engagement, post-crash management and safety measures for pedestrians and users of dedicated lanes (2–4).

Legislative reforms and enforcement of traffic laws

Saudi Arabia has strengthened penalties for dangerous road behaviours, including over-speeding, reckless driving, seatbelt violations and mobile phone use while driving. The demerit points system applies escalating sanctions for repeat offences, from temporary licence suspension to licence withdrawal. Non-Saudi drivers who repeatedly violate traffic laws may face deportation. Those caught driving while their licences are suspended may face fines and imprisonment, depending on the length of suspension. Drivers under permanent

Table 2 Government road safety initiatives in Saudi Arabia

Domain/initiative	Key actions and components	Intended impact
Vision 2030 framework	Adoption of the Safe System Approach; safer road design; stricter laws and enforcement; demerit points system; graduated driver licensing; enhanced vehicle inspection; expanded pedestrian and public transport infrastructure; public education campaigns	Reduce road deaths and injuries; improve road-user behaviour; promote safe and sustainable mobility
Ministerial Traffic Safety Committee	Established in 2018 to coordinate multisectoral road safety action, including enforcement, data collection, trauma care, infrastructure, vehicle safety, traffic management, public awareness and pedestrian safety	Strengthen coordination, policy integration and national road safety governance
Legislative reforms and traffic enforcement	Stronger penalties for speeding, seatbelt violations and mobile phone use while driving; escalating sanctions through the traffic points system, including possible licence suspension and deportation of repeat non-Saudi offenders; automated enforcement through Saher; real-time detection of violations; mandatory inspections, speed limiters, driver training, electronic logging and advanced driver assistance systems for heavy goods vehicles and public service vehicles	Improve compliance with traffic laws; deter violations; strengthen monitoring and reduce preventable driver- and vehicle-related risks
Infrastructure development and road safety improvements	Major investments under Vision 2030, including upgraded highways, guardrails and improved signage; speed bumps, roundabouts, pedestrian bridges and crossings in major cities	Reduce accident severity; protect pedestrians and other vulnerable users; improve traffic flow
Technology and data-driven road safety	Use of geographic information systems, artificial intelligence and smart traffic management; predictive modelling for high-risk areas; mobile applications for real-time alerts and traffic information	Identify high-risk locations; prevent secondary accidents; support evidence-based interventions
Public awareness and education	National campaigns by the Ministry of Interior, General Directorate of Traffic and Saudi Traffic Safety Society on speeding, distraction, child safety and seatbelt use; Gulf and Arab Traffic Safety Week activities; school and university partnerships	Promote safer driving culture; increase compliance with safety measures; strengthen community participation in road safety

suspension may regain licences after 2 years if they complete approved training (24,25).

The Saher system, launched in 2010, links traffic management, vehicle monitoring and automated enforcement across major Saudi cities. Through a network of digital cameras connected to the National Information Center, it regulates traffic lights according to vehicle volume, tracks traffic department vehicles to improve response times, identifies vehicles at city entrances and exits, displays real-time information for drivers, monitors traffic flow and detects violations using fixed and mobile radars. Command-and-control centres in 8 cities manage these functions in real time. When a violation is detected, cameras capture the vehicle licence plate, the owner's information is retrieved from the national database, and the ticket is issued electronically (26).

Regulations for heavy goods vehicles and public service vehicles have also been strengthened. These measures include stricter licensing requirements, advanced driver training, regular assessments, mandatory vehicle inspections and speed-limiting devices. Electronic logging devices are used to monitor driving hours and help prevent fatigue-related accidents, and advanced driver assistance systems, including collision avoidance and lane departure warning systems, are encouraged (27).

Infrastructure, technology and road safety improvements

As part of Vision 2030, Saudi Arabia has invested substantially in road infrastructure and safety engineering, including safer road designs, upgraded highways, guardrails and improved signage across the country. Urban planning increasingly incorporates speed bumps, roundabouts and traffic-calming measures, while pedestrian bridges and crossings in major cities such as Riyadh and Jeddah aim to reduce pedestrian-related accidents. These efforts are intended to improve safety on highways, where severe accidents are common, and in urban settings, where vulnerable road users face greater risk (28,29).

Technology is being used to support road safety planning and traffic management. In addition to the Saher system, authorities use geographic information systems, artificial intelligence and smart traffic management to identify accident-prone areas, predict risk and improve traffic flow. These systems can adjust traffic signals automatically, communicate with emergency services

and provide real-time traffic updates and hazard alerts through mobile applications to support safer driving (30,31).

Public awareness and education

Public education remains central to Saudi Arabia's road safety strategy. The Ministry of Interior, General Directorate of Traffic and Saudi Traffic Safety Society (*Salamh*) run campaigns on speeding, distraction and impaired driving. During the Gulf and Arab Traffic Safety Week, lectures, workshops and media campaigns promote seatbelt use and safe driving. *Salamh* produces educational content on child seat safety, intersections and overtaking. Social media is used to reach younger populations, and partnerships with schools, universities and private sector organisations help integrate road safety messages into education and driver training (32,33).

Study limitations

This review has some limitations. The included sources varied in design, data sources and outcome definitions, limiting comparability and precluding quantitative synthesis. Official statistics and reports may have been affected by underreporting or changes in data collection methods over time. The evidence was not collected through a systematic search, study quality was not assessed and causal relationships could not be established.

Conclusion

Saudi Arabia has achieved measurable reductions in road traffic accidents, injuries and fatalities during the past decade, reflecting sustained national attention to road safety. Reforms combine the safe system approach with stronger traffic enforcement, improved vehicle safety standards, infrastructure upgrades, emergency response, public education and technology-supported traffic management. Maintaining progress towards the Vision 2030 road safety target will require consistent enforcement, stronger compliance with seatbelt requirements and restrictions on distracted driving, continued infrastructure improvements and data-driven action on high-risk behaviours and locations.

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